SECTION 16400 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specification sections, apply to work of this Section.

B. Division 16050 Basic Electrical Provisions apply to work specified in this Section.

C. The contractor shall provide and install an automatic emergency transfer switch in conjunction with the specified stand-by generator set, complete.

1.02 SUMMARY

A. Furnish and install non-automatic transfer switches (NTS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. Refer to Section 16120 wire and cable, conduit and boxes which are required in conjunction with transfer switch work; not work of this Section.

C. The transfer switch shall be provided by the natural gas generator manufacturer and shall be of the size and capacity required by the generator. The switch shall be warranted by the generator manufacturer to shall be responsible for a complete one source standby power system.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data, shop drawings, wiring diagrams, and parts and maintenance manuals and installation instructions for the automatic transfer switch.
B. Shop Drawings: Submit layout drawings of electrical power transfer switches showing accurately scaled equipment locations and spatial relationships to associated electrical equipment in proximity.

C. Wiring Diagrams: Submit manufacturer's catalog data, wiring diagrams for electrical transfer switches, and associated control devices showing connections to prime and alternate power sources, electrical load, and equipment components.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of automatic electrical power transfer switches, of types, ratings, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects utilizing electrical power transfer switches similar to that required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of electrical power transfer switches.

2. UL Compliance: Comply with applicable requirements of UL 1008, "Automatic Transfer Switches", and UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide transfer switches and components which are UL-listed and labeled.

3. NEMA Compliance: Comply with applicable requirements of NEMA Standards. Pub/No.'s ICS 2, "Industrial Control Devices, Controllers and Assemblies", ICS 6 and 250, pertaining to transfer switches.

4. NFPA Compliance: Comply with applicable requirements of NFPA 70, National Electrical Code, NFPA 110 "Emergency and Stand-by Power Systems."
1.05  **DELIVERY, STORAGE AND HANDLING**

A. Deliver transfer switches and associated devices in factory fabricated type containers or wrappings, which properly protect equipment from damage.

B. Store transfer switches and associated devices in original packaging, and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle transfer switches and associated devices carefully to prevent physical damage to equipment. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

**PART 2 - PRODUCTS**

2.01  **MANUFACTURERS**

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Electrically Operated Automatic Transfer Switches which may be incorporated in the work include, but are not limited to, the following:

1. Asco Power Technologies.
2. Square D Co.
3. Automatic Switch Co.
4. Seimens

2.02  **GENERAL AUTOMATIC TRANSFER-SWITCH PRODUCT REQUIREMENTS**

A. All Switches shall be CSA approved.

B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated. The main switch shall be rated for a minimum of 600 volts.
D. Tested Fault-Current Closing and Withstand Ratings: Adequate for
duty imposed by protective devices at installation locations in
Project under the fault conditions indicated, based on testing
according to UL 1008. The switch shall be rated for 100 % continuous
duty.

1. Where Transfer Switch Includes Internal Fault-Current
Protection: Rating of switch and trip unit combination
exceeds indicated fault-current value at installation location.

E. Annunciation, Control, and Programming Interface Components:
Devices at transfer switches for communicating with remote
programming devices, annunciators and control panels have
communications capability matched with remote device.

F. Solid-State Controls: Repetitive accuracy of all settings is plus or
minus 2 percent or better over an operating temperature range of
minus 20 to plus 70 deg C.

G. Resistance to Damage by Voltage Transients: Components meet or
exceed voltage-surge withstand capability requirements when
tested according to IEEE C62.41. Components meet or exceed
voltage-impulse withstand test of NEMA ICS 1.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Enclosures: NEMA 4X stainless steel, unless otherwise indicated on
the construction plans.

J. Factory Wiring: Train and bundle factory wiring and label consistent
with Shop Drawings, either by color code or by numbered or
lettered wire and cable tape markers at terminations.

1. Designated Terminals: Pressure type suitable for types and
sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space:
Suitable for top, side, or bottom entrance of feeder
conductors as indicated.

3. Control Wiring: Equipped with lugs suitable for connection to
terminal strips.
K. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

L. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

2.03 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.

2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.

3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Initiation occurs without active control of generator set.
   b. Controls ensure closed-transition load transfer closure occurs only when the two sources are within plus or minus 5 electrical degrees, maximum and plus or minus 5 percent maximum voltage difference.

4. Failure of the power source serving the load initiates automatic break-before-make transfer.
E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled, unless both sources are live.

2.04 AUTOMATIC TRANSFER-SWITCH FEATURES

A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes; factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

E. Test Switch: Simulates normal-source failure.

F. Switch-Position Pilot Lights: Indicate source to which load is connected.


1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."


H. Unassigned Auxiliary Contacts: Two normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

J. Engine Starting Contacts: One isolated, normally closed and one isolated, normally open, rated 10 A at 32-V dc minimum.

L. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes; factory set for five minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.

M. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

2. Push-button programming control with digital display of settings.

3. Integral battery operation of time switch when normal control power is not available.

2.05 FINISHES

A. Enclosures: Manufacturer's standard corrosion-resistant stainless steel finish.

2.06 SOURCE QUALITY CONTROL

A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Floor-Mounted Switch: Level and anchor unit to floor.

B. Annunciator and Control Panel Mounting: Flush on wall, unless otherwise indicated on the construction plans.

C. Identify components according to Division 16 Section 16050 "Basic Electrical Materials."

D. Identify components according to Division 16 Section 16075 "Electrical Identification."

E. Install transfer switches, including associated control devices as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that transfer switches comply with requirements. Comply with applicable requirements of NEC and NFPA pertaining to wiring practices and installation of electrical power transfer switches.
F. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of transfer switch work with other work.

G. Transfer switches or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.

H. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

3.02 WIRING TO REMOTE COMPONENTS

A. Match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer. Increase conduit or raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.03 CONNECTIONS

A. Ground equipment as indicated and as required by NFPA 70.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing under the supervision of the manufacturer's factory-authorized service representative in addition to tests recommended by the manufacturer:

1. Before energizing equipment, after transfer-switch products have been installed:

3. Check for electrical continuity of circuits and for short circuits.

4. Inspect for physical damage; proper installation and connection; and integrity of barriers, covers, and safety features.

5. Verify that manual transfer warnings are properly placed.

6. Perform manual transfer operation.

B. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

1. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

2. Simulate loss of phase-to-ground voltage for each phase of normal source.


4. Verify pickup and dropout voltages by data readout or inspection of control settings.

5. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

C. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

1. Assist in verifying grounding connections and locations and ratings of sensors.

2. Assist in observing reaction of circuit-interrupting devices when simulated fault current is applied at sensors.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
3.05 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Engineer, with at least seven days' advance notice.
4. Provide a minimum of four hours of instruction.

END OF SECTION